

edited by Gilbert Chin

## CHEMISTRY

## Making a Zeolite Leaf

Porous materials, such as zeolites, are commonly synthesized by using "sacrificial templates" that are removed after synthesis. A similar imprinting process occurs when biological specimens are fossilized, resulting in mineralized impressions that preserve complex and hierarchical structures. In fact, single-celled algae and wood have actually been used as templates for zeolite synthesis, but these efforts relied on the addition of "seed" crystals.

Valtchev *et al.* show that amorphous silica (an intrinsic constituent of many plants) can induce fast and uniform nucleation of zeolite without requiring seed crystals. Freeze-dried leaves of *Equisetum arvense* (field horsetail) have a high content of silica (about 13 weight %). After hydrothermal treatment with a silica-containing solution, the leaves were transformed into a combined micro- and macroporous zeolite material that retained the morphology of the original leaves. — JFU

*Angew. Chem. Int. Ed.* **42**, 2782 (2003).

caused by metastases; these densities are detectable by MRI. The analysis of 80 prostate cancer patients indicates that this imaging method is more sensitive and specific than conventional MRI, suggesting that larger prospective trials of the technology are warranted. — PAK

*N. Engl. J. Med.* **348**, 2491 (2003).

## DEVELOPMENT

## Turning Inside Out

During development, embryos of the multicellular green alga *Volvox carteri* form a spherical monolayer of cells that must turn inside out in order to produce the mature spheroid alga in which reproductive cells are enclosed inside a somatic cell layer. To perform this feat, a tight curve must be produced, involving dramatic rearrangements of cell shape and position. Nishii *et al.* identified the gene *invA*, which was required for inversion. The *InvA* protein belongs to a family of microtubule-dependent molecular motors known as kinesins. In mutant alga lacking *InvA*, cells changed shape as usual, but inversion failed because of the inability of cells to move with respect to the intercellular cytoplasmic bridges. It is this movement that is needed to generate and maintain the fold in the cell layer required for inversion. — SMH

*Cell* **113**, 743 (2003).

A scanning electron micrograph of a stalled inverting embryo.



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## CLIMATE SCIENCE

## In a Haze

Intense plumes of pollution downwind of Asia (eastward) and India (southwestward) have been documented. These plumes are due largely to industrial and vehicular emissions, biomass burning, and wind-blown dust. They have a major impact on the radiative properties and chemical compositions of the atmosphere in these regions, and thus have potential environmental and climatological effects. Moreover, long-range transport can influence air quality far from the pollution sources. Several field campaigns have been conducted to measure the chemical composition, optical properties, and amount of aerosols in these plumes, and the findings have made clear how dramatic these events are.

What about the quality of the air in the region downwind of the world's biggest energy user, the United States? Quinn *et al.* report similar mass loadings, optical depths, and ozone concentrations in a field study done from aboard a ship off the East Coast, although there was a much higher concentration of particulate organic matter in the U.S. plume. These pollution

events are severe enough that adverse effects on human health are a concern. — HJS

*Geophys. Res. Lett.* **30**, 1555 (2003).

## GEOLOGY

## Rock Barbeque

High surface heat flux, smoke and hot gases emanating from holes, and fractures in the Timbuktu region of northern Mali have been recorded since the late 1800s. Studies in the second half of the 1900s interpreted these features as a hydrothermal system developing from a growing magma body produced by tectonic processes. On the other hand, West Africa is part of a stable craton, and there is not much evidence for volcanism.

Thermal activity increased near Lac Faguibine in April 2001. Svensen *et al.* conducted a field study and found that the volcanism is actually subsurface combustion. Buried beneath diatomaceous clay, an organic-rich peat layer dries, heats up via exothermal microbial decomposition, self-ignites, and propagates radially or along a fracture at a rate of 3 cm per hour. The overlying diatomite warms and the iron oxidizes, turning the clay layer from gray to red. Red di-

atomite is common in the trans-Saharan region, where many lakes dried up during a Holocene climate change, and therefore may provide a marker to estimate the extent and effect of subsurface combustion on the environment. — LR

*Geology* **31**, 581 (2003).

## BIOMEDICINE

## Cancer Detection in the Iron Age

Prostate cancer accounts for about 15% of all cancers in men in developed countries. A critical factor in treatment decisions for newly diagnosed patients is whether the tumor has metastasized to local and distant lymph nodes. Unfortunately, current methods for noninvasive detection of metastases are limited in their sensitivity.

Harisinghani *et al.* report promising results from a clinical study combining high-resolution magnetic resonance imaging (MRI) with an imaging agent: lymphotropic superparamagnetic nanoparticles. These iron-containing particles target to lymph nodes and accumulate when there are disturbances in lymph flow or nodal architecture

# APPLIED PHYSICS

## Burning Holes in Glass

In the field of optics, there is great interest at present in manipulating light with periodically structured optical materials, known as photonic crystals. However, the fabrication processes of these optical materials can be quite demanding, and simpler routes are being sought. Taylor *et al.* demonstrate the ability to pattern structures (holes) directly in optical-quality silica using femtosecond laser pulses. The pulses modify the refractive index of the material locally, and a subsequent HF etching step leaves behind a smooth-walled conically-shaped hole, the diameter of which can be varied from 0.1 to 1.0  $\mu\text{m}$ . It is also feasible to fabricate two holes, just 1.4  $\mu\text{m}$  apart, which raises the possibility of using the technique to produce high-quality two-dimensional photonic crystals. — ISO

*Opt. Lett.* **28**, 1043 (2003).

# PHARMACOLOGY

## Mixing and Matching

The reductionist philosophy within molecular and cellular biology has dominated the past several decades, but systems-level analyses are making a comeback, empowered by the advent of large data sets: genome sequences, RNA microarrays, and proteomic maps. Extending this resurgence to drug discovery, Borisy *et al.* describe an analysis of binary combinations of agents that, when administered together, display a therapeutic efficacy greater than the sum of the single components.

To combat the problem of increasing resistance to antifungal drugs, they pair fluconazole with phenazopyridine (a urinary tract analgesic) and observe a fungicidal effect on a resistant strain of *Candida albicans*; this synergy appears to be due to the potent inhibition of the multidrug resistance pump. A second instance of unpredictably cooperative drugs involves the antipsychotic chlorpromazine and the antiprotozoal pentamidine. Neither is potent on its own, yet this pair inhibited the growth of A549 lung carcinoma cells in a mouse model more effectively than paclitaxel, an anticancer drug that is used clinically. It does not seem beyond belief that the development of multidrug cocktails aimed at several targets may, in fact, herald a re-

evaluation of so-called folk medicine mixtures concocted by trial and error over many generations. — GJC

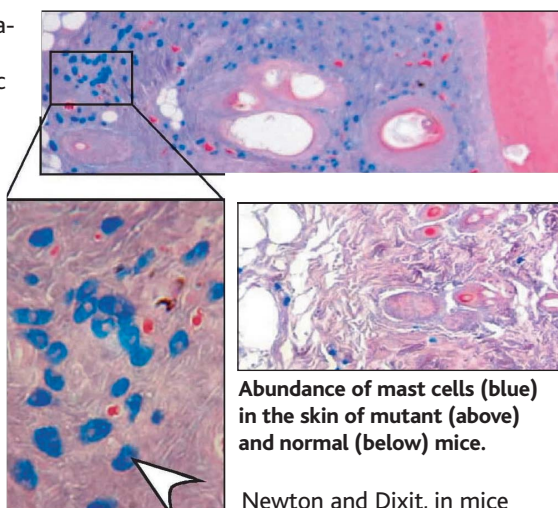
*Proc. Natl. Acad. Sci. U.S.A.* **100**, 7977 (2003).

# IMMUNOLOGY

## Lymphocyte Signaling on the CARDS

Antigen recognition by lymphocytes leads to the construction of membrane-associated complexes that mediate the signals that initiate the transcription of immune response genes. Caspase recruitment domain (CARD)-containing proteins, such as Bcl10 and Carma1, help regulate this activity through contact with each other and with other members of the signaling complex.

Hara *et al.* found that Carma1-deficient mice were defective in natural killer (NK) and B cell development and displayed severely impaired receptor-mediated activation of downstream proteins NF- $\kappa$ B and JNK in T and B cells. Using genome-wide mutagenesis, Jun *et al.* disrupted Carma1 function via a point mutation, producing signaling defects similar to those seen in Carma1-deficient mice although T cell function was not as severely compromised. These animals also produced excessive IgE antibody and developed allergic skin pathology, suggesting that the partial T cell defect may have contributed to T helper cell dysfunction.



**Abundance of mast cells (blue) in the skin of mutant (above) and normal (below) mice.**

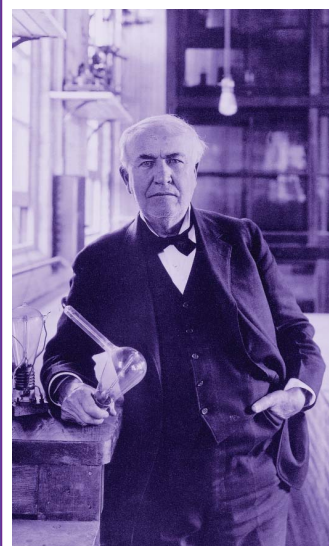
Newton and Dixit, in mice expressing a CARD-less

Carma1, observed similar defects in B and T cell proliferation. These studies reveal an unexpected level of versatility by Carma1 in coordinating the pathways required for lymphocyte activation. — SJS

*Immunity* **18**, 763; 751 (2003); *Curr. Biol.* **10**.1016/S0960982203004585 (2003).

*In 1880*

ANOTHER  
LIGHT BULB  
WENT ON.



Thomas Alva Edison with the Edison effect bulb, c.1918

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